



EHR ADVISORY COMMITTEE MEETING

April 25, 2019

Francisco Rodriguez

EHR AC Chair

Chancellor
L.A. Community College District



EHR

DIRECTORATE FOR
EDUCATION & HUMAN RESOURCES



EHR ADVISORY COMMITTEE MEETING April 25, 2019

Karen Marrongelle

Assistant Director
Education and Human Resources

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DIRECTORATE FOR
EDUCATION & HUMAN RESOURCES



- **EHR Highlights**

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Creating Solutions. Inspiring Action.

Reskilling America's Workforce

EXPLORING THE NATION'S
FUTURE STEM WORKFORCE NEEDS

Recommendations for Federal Agency Engagement

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National Science Foundation

FY 2020

BUDGET REQUEST TO CONGRESS

EHR

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NSF's 10 Big Ideas | **Enabling Ideas**

Growing Convergence Research at NSF



NSF 2026: Seeding Innovation



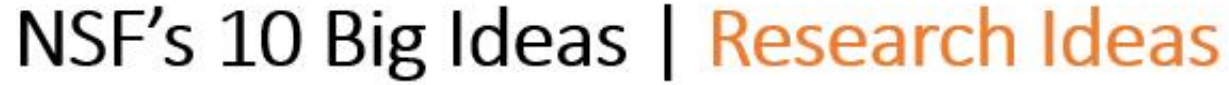
**NSF INCLUDES: Enhancing STEM through
Diversity and Inclusion**



Mid-scale Research Infrastructure



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- **Initial Reflections**
- **Aspirations for EHR**
- **Educating Students for the Future**

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A Celebration of Life



Dr. Julio E. López-Ferrao

National Science Foundation

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Session 1: Federal STEM Education 5-Year Strategic Plan

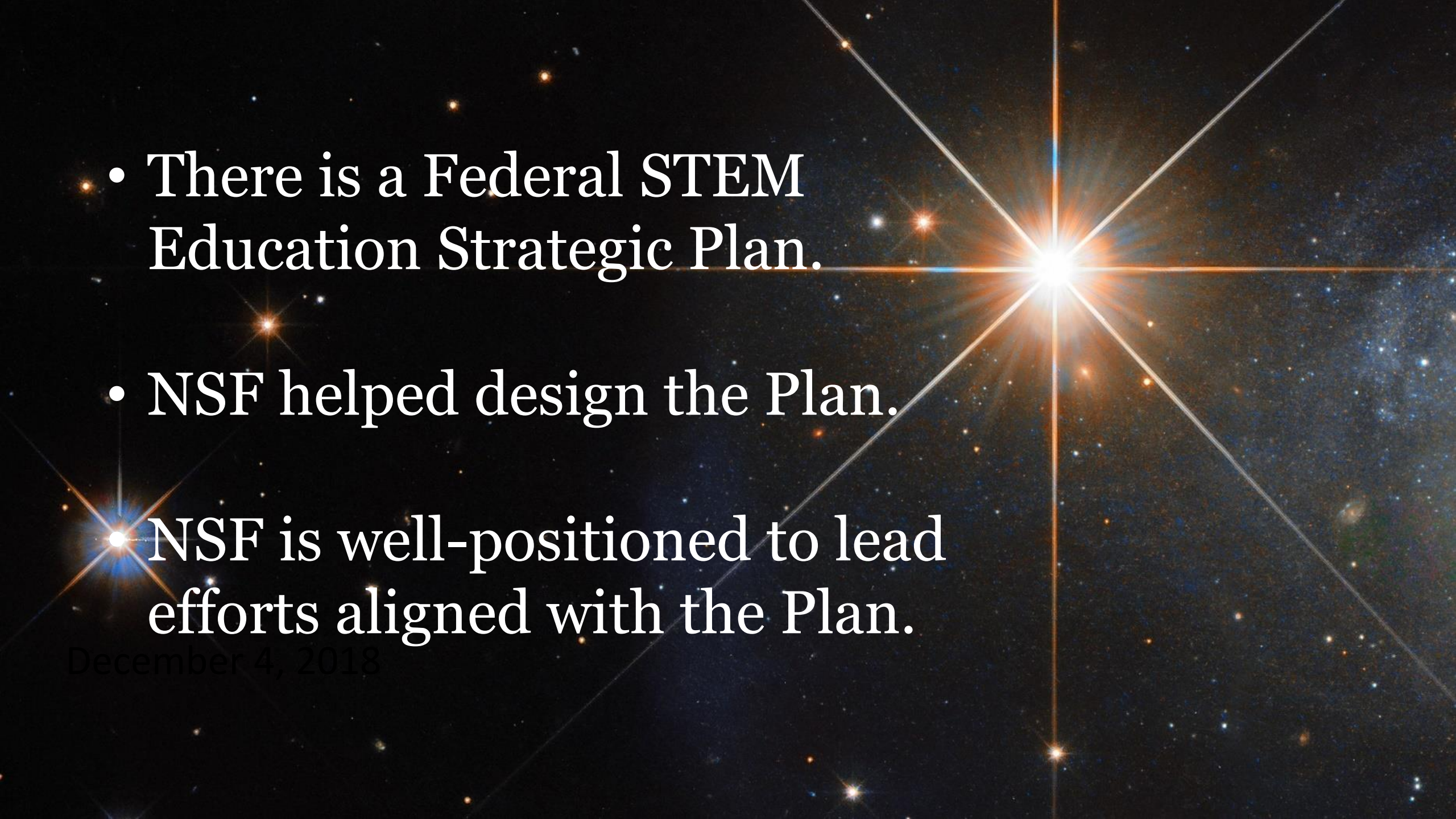
Moderator: Karen Marrongelle,
Assistant Director, EHR



Charting a Course for Success: America's Strategy For STEM Education

December 4, 2018

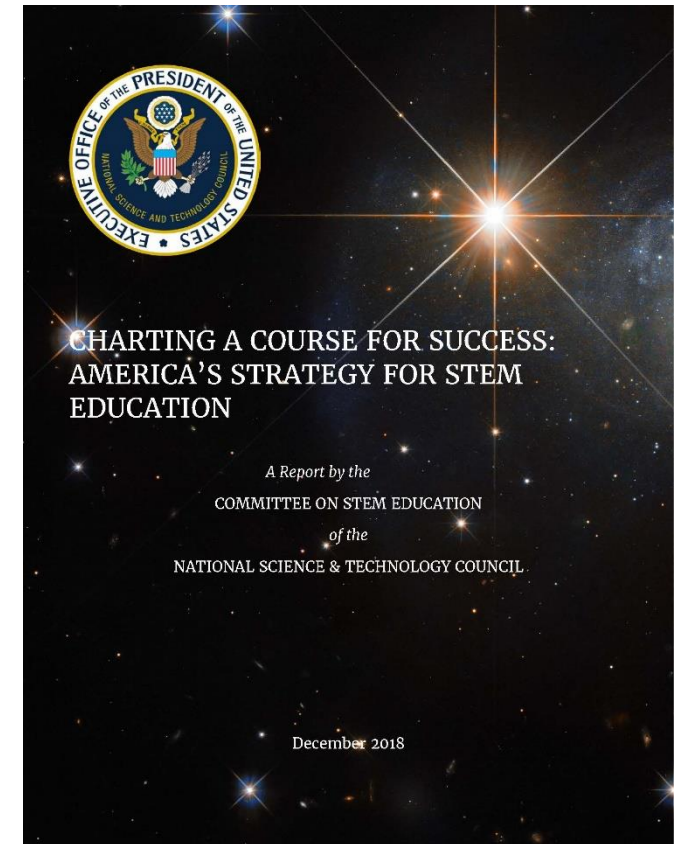
Karen Marrongelle
Assistant Director, Education and Human Resources

- 
- The background of the slide is a deep space image featuring a bright star with prominent diffraction spikes and a crosshair pattern. The star is located in the upper right quadrant. The background is filled with numerous smaller stars and a faint, blue-tinted nebula or galaxy structure. The text is overlaid on the left side of the image.
- There is a Federal STEM Education Strategic Plan.
 - NSF helped design the Plan.
 - NSF is well-positioned to lead efforts aligned with the Plan.

December 4, 2018

Why a Federal Strategic Plan for STEM Education?

- America COMPETES Reauthorization Act (2010) requires a new plan every 5 years
- Basic STEM literacy vital to America's future, particularly our Nation's future workforce
- Call for interagency collaboration and for public engagement



A Strategy Informed by Stakeholder Input



- State-level STEM Education Specialists
- K-12 STEM Educators
- University STEM Faculty
- Non-profit organizations
- Informal science educators

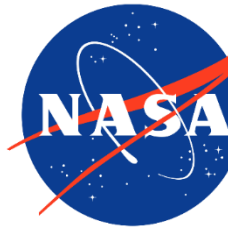
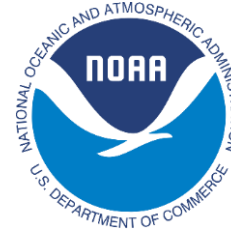
An Interagency Effort



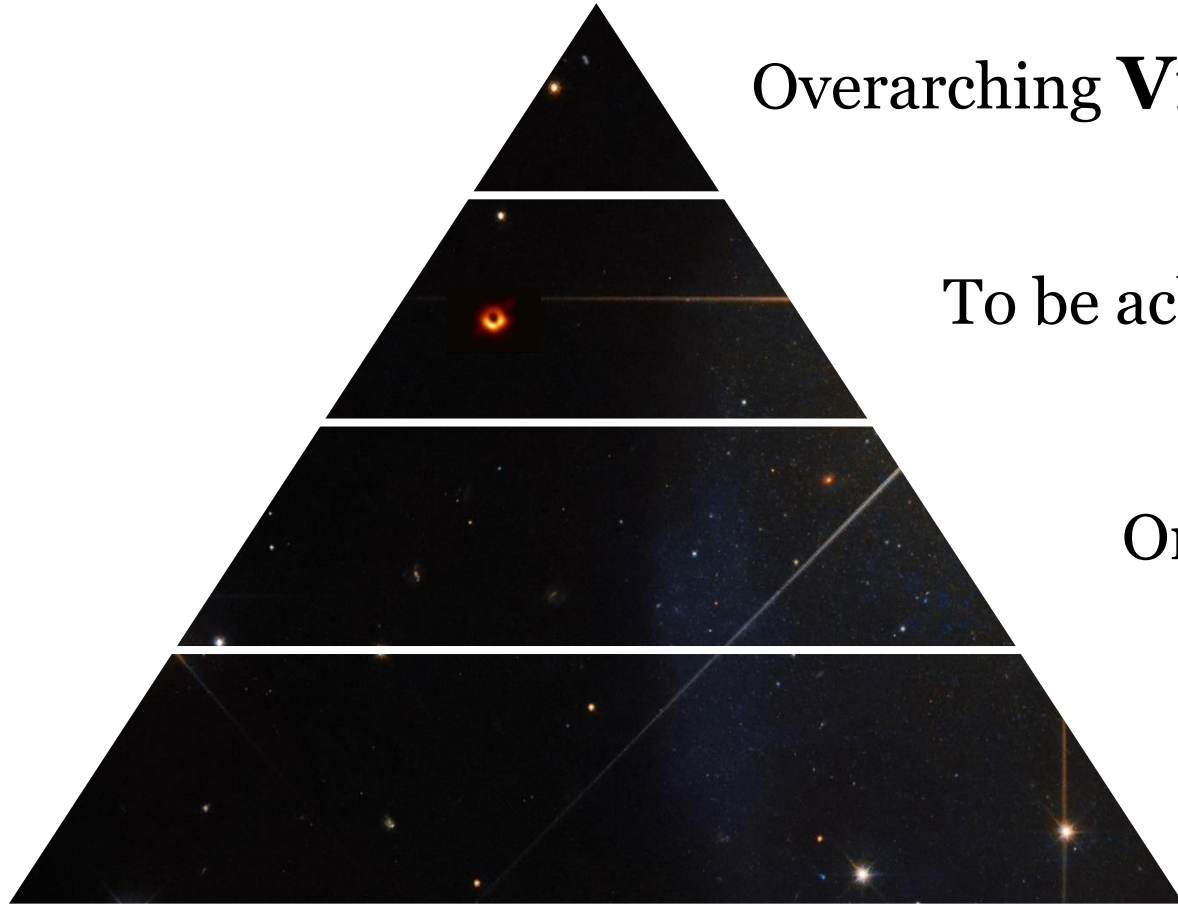
An Interagency Effort



Smithsonian



Strategic Plan Outline



Overarching **Vision** for the future of U.S. STEM education

To be achieved by pursuing 3 aspirational **Goals**

Organized around 4 **Pathways**

Pathways contain specific **Objectives**

Goals of the Strategic Plan

- Build Strong Foundations for **STEM Literacy**
- Increase **Diversity, Equity, and Inclusion** in STEM
- Prepare the **STEM Workforce** for the Future

Goals align with NSF's mission: To promote the progress of science; to advance the national health, prosperity, and welfare; and to secure the national defense; and for other purposes.

Pathway: Develop and Enrich Strategic Partnerships

- Advanced Technological Education (ATE)



Pathway: Build Computational Literacy

- Computer Science for All (CSforAll)
- Improving Undergraduate STEM Education: Computing in Undergraduate Education



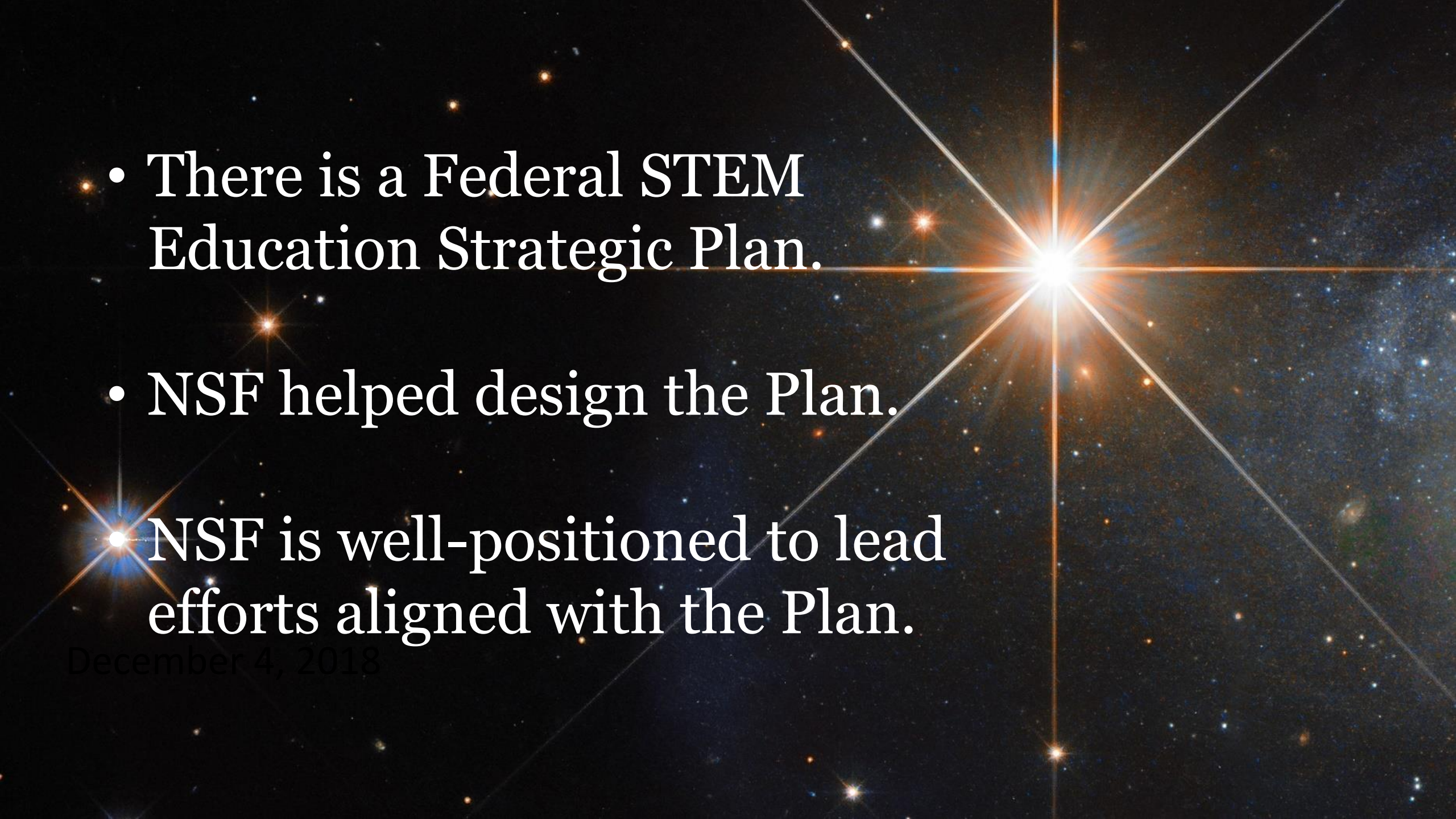
Additional Examples of NSF Activities aligned with the Plan:

- NSF INCLUDES National Network
- NSF Data Science Corps
- NSF INTERN
- NSF-Boeing Partnership

Pathways	Objectives	DOC	DoD	DOE	DHS	DOI	DOL	DOS	DOT	ED	EPA	HHS	NASA	NSF	SI	USDA
Develop and Enrich Strategic Partnerships	Foster STEM Ecosystems that Unite Communities	•		•	•	•	•	•	•	•	•	•	•	•	•	•
	Increase Work-Based Learning and Training through Educator-Employer Partnerships	•	•	•	•	•	•			•	•	•	•	•	•	•
	Blend Successful Practices from Across the Learning Landscape	•	•	•	•		•	•		•	•			•	•	•
Engage Students where Disciplines Converge	Advance Innovation and Entrepreneurship Education	•		•				•		•	•	•		•		•
	Make Mathematics a Magnet	•	•							•				•		•
	Encourage Transdisciplinary Learning	•	•	•	•	•		•		•	•	•	•	•	•	•
Build Computational Literacy	Promote Digital Literacy and Cyber Safety	•	•		•			•		•		•		•		•
	Make Computational Thinking An Integral Element of All Education	•	•	•	•	•				•		•		•	•	•
	Expand Digital Platforms for Teaching and Learning	•		•	•			•		•				•	•	•

Next Steps

- In support of the Pathway: Operate with Transparency and Accountability
 - Implementation Plan
 - Interagency Working Groups

- 
- There is a Federal STEM Education Strategic Plan.
 - NSF helped design the Plan.
 - NSF is well-positioned to lead efforts aligned with the Plan.

December 4, 2018

The logo for the Directorate for Education & Human Resources (EHR) features the letters "EHR" in a large, bold, white sans-serif font against a green background with abstract, flowing lines.

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Session 1: *(Panel) Federal STEM Education 5-Year Strategic Plan*

Panelists:

Karen Marrongelle, Assistant Director, EHR and Co-Chair, Federal Coordination in STEM Education (FC-STEM) Subcommittee

Lloyd Whitman, Assistant to the Director for Science Policy and Planning, Office of the Director, NSF

Jon Werner-Allen, American Association for the Advancement of Science (AAAS) Policy Fellow, White House Office of Science and Technology Policy

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Session 1: Discussion on Federal STEM Education 5-Year Strategic Plan

Moderator: Karen Marrongelle
Assistant Director, EHR

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Morning Break

10:30 – 10:45AM

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Session 2: *EHR Evaluation and Monitoring in the Federal Context*

Moderator: Sarah-Kay McDonald
Senior Advisor, Office of the
Assistant Director, EHR

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EHR Evaluation & Monitoring in the Federal Context



Presented to the EHR Advisory Committee's Spring 2019 Meeting
Thursday April 25, 2019

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Evaluation & Monitoring (E&M) in EHR: A brief history

Organizing our work

- Division of Research, Evaluation, & Dissemination (RED)
- Division of Research, Evaluation, & Communication (REC)

The screenshot shows the '2004 Guide to Programs' for the Directorate for Education and Human Resources, Division of Research, Evaluation, and Communication (REC). The page includes a search bar, a table of contents, and a detailed description of the REC division's mission and programs. The table of contents lists sections such as Introduction, General Information, Crosscutting Investment Strategies, and specific programs like the Role Program, EREC, and CAREER. The main content area provides an overview of the REC division's goals and lists several key programs and activities.

2004 Guide to Programs

CONTENTS

- INTRODUCTION
- GENERAL INFORMATION
- CROSSCUTTING INVESTMENT STRATEGIES
- DIRECTORATE FOR BIOLOGICAL SCIENCES (BIO)
- DIRECTORATE FOR COMPUTER AND INFORMATION SCIENCE AND ENGINEERING (CISE)
- DIRECTORATE FOR EDUCATION AND HUMAN RESOURCES (EHR)**
 - Math and Science Partnership (MSP)
 - Division of Elementary, Secondary, and Informal Education (ESIE)
 - Division of Graduate Education (DGE)
 - Division of Human Resource Development (HRD)
 - Division of Research, Evaluation, and Communication (REC)
 - Division of Undergraduate Education (DUE)
 - Experimental Program to Stimulate Competitive Research (EPSCoR)

SEARCH

This document has been archived. For current NSF funding opportunities, see http://www.nsf.gov/funding/browse_all_funding.jsp

DIRECTORATE FOR EDUCATION AND HUMAN RESOURCES
Division of Research, Evaluation, and Communication

The Division of Research, Evaluation, and Communication (REC) seeks to:

- advance research on science, technology, engineering, and mathematics (STEM) education and improve evaluative research on STEM education programs;
- increase the capacity of the field to conduct high-quality, innovative, useful, and credible STEM education evaluation or research studies; and
- increase the capacity of STEM education researchers and STEM education program evaluators to communicate the results of their research.

The REC Division supports the following programs and activities:

1. [Research on Learning and Education \(ROLE\)](#)
2. [Evaluative Research and Evaluation Capacity Building \(EREC\)](#)
3. [Crosscutting Programs and Activities](#)
4. [Technical Assistance Contracts for Assessment, Evaluation, and Communication of EHR's Programs and Activities](#)

1. Research on Learning and Education (ROLE)

The ROLE Program supports research across a continuum that includes (1) the biological basis of human learning; (2) behavioral, cognitive, affective, and social aspects of human learning; (3) science, technology, engineering, and mathematics (STEM) learning in formal and informal educational settings; and (4) changing educational systems to improve STEM learning. ROLE aims to advance the knowledge base within and across the intersections of these multidisciplinary areas.

2. Evaluative Research and Evaluation Capacity Building (EREC)

The EREC Program supports projects that offer unique approaches to evaluation practice in the generation of knowledge for the science, technology, engineering, and mathematics (STEM) education community, and for broad policymaking within research and education enterprises. EREC also supports projects to increase the capacity of the field to conduct high-quality, innovative, useful, and credible STEM education evaluation studies.

3. Crosscutting Programs and Activities

REC participates in several of NSF's crosscutting activities, including interdisciplinary programs, programs that are supported by multiple NSF Directorates, international activities, and programs jointly supported by NSF and other federal agencies. The primary REC crosscutting activities are listed alphabetically below.

- **Faculty Early Career Development (CAREER)**—The CAREER Program recognizes and supports the early career development activities of those teacher-scholars who are most likely to become the academic leaders of the 21st century. CAREER proposals are welcome in the research areas identified in the unified EREC-ROLE program announcement, available through the NSF Online Document System at http://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf03542. CAREER proposals may also address the research questions or areas of interest identified by other EHR Divisions and programs. Frequently asked questions about CAREER

<https://www.nsf.gov/od/lpa/news/publicat/nsf04009/ehr/rec.htm>



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Evaluation & Monitoring (E&M) in EHR: A brief history

Building evaluation capacity

- **Resources** *e.g.*,
 - *User-Friendly Handbook for Project Evaluation* (NSF 02-057)
 - *User-Friendly Handbook for Mixed Method Evaluations* (NSF 97-153)



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Evaluation & Monitoring (E&M) in EHR: A brief history

Building evaluation capacity

- Resources
- **Funding for innovations in evaluation** *e.g.*,
 - *Evaluative Research and Evaluation Capacity Building (EREC)*
 - *Promoting Research and Innovation in Methodologies for Evaluation (PRIME)*
 - *Methods to Protect Privacy in State Longitudinal Data Systems Research Files* (#1437953)
 - *Project FOCIS: Framework for Observation and Categorization of Interest in Science* (#1335784)
 - *Building Community and Capacity for Data-Intensive Evidence-Based Decision Making in Schools and Districts* (#1560720)
 - *Planning Cluster Randomized Trials: An Empirical Investigation of Design Parameters for Studies of Science Teacher Interventions* (#1544236)



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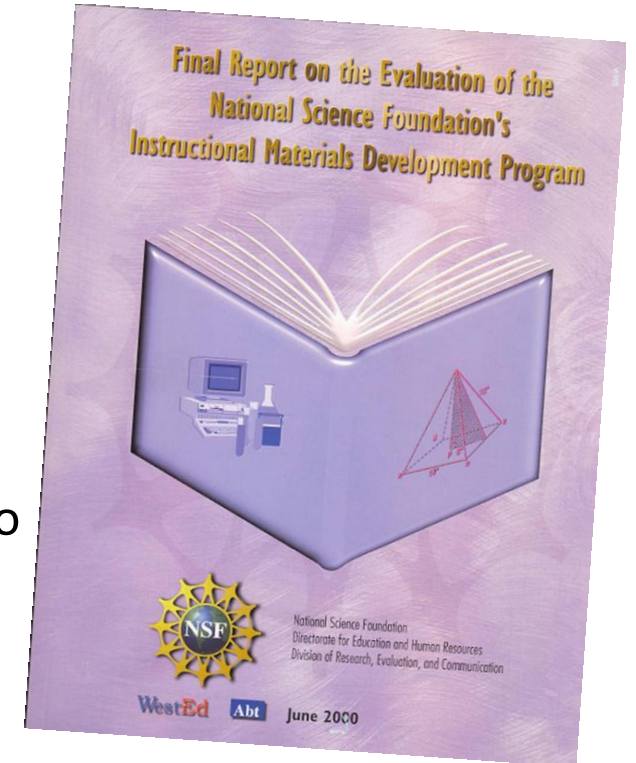
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Evaluation & Monitoring (E&M) in EHR: A brief history

Generating evidence re EHR investments

- **Program evaluations** *e.g.*,
 - IMD: Explored issues related to the development, dissemination, adoption, implementation, and impact of materials created with NSF support.
 - IGERT: Examined how helpful trainees perceive specific training to be in developing their capacity to conduct interdisciplinary research, and how trainee development as interdisciplinary scientists was assessed.



<https://www.nsf.gov/pubs/2000/nsf0071/nsf0071.pdf>



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Evaluation & Monitoring (E&M) in EHR: A brief history

Generating evidence re EHR investments

- Program evaluations
- **Program management** *e.g.*,
 - Project Outcomes Report for the General Public
 - Committee of Visitors (COV) reviews



The Project Outcomes Report is Available on Research.gov

The Project Outcomes Report for the General Public is a required report, written by Principal Investigators (PIs) specifically for the public, to provide insight into the outcomes of National Science Foundation (NSF)-funded research. The America COMPETES Act (ACA) of 2007, Section 7010, requires that research outcomes and citations of published documents resulting from research funded, in whole or in part, by NSF be made available to the public in a timely manner and electronic format. The Project Outcomes Report is available to the public through Research.gov's Research Spending & Results service. Research Spending & Results provides transparent and open access to award information by offering a complete picture of the award, including: award details, award abstract at the time of award, citations of publications resulting from the award, and now the outcomes of funded research.

The Project Outcomes Report for the General Public is:

- Required for new awards made or existing awards that receive funding amendments on or after January 4, 2010
- Prepared and submitted by the Principal Investigator (PI) or co-PI using Research.gov within 90 days following award expiration
- Posted for public viewing exactly as submitted by the PI/co-PI without review or approval by NSF, and accompanied by a disclaimer
- Established in NSF policy in the January 2010 Proposal and Awards Policies and Procedures Guide, see http://www.nsf.gov/pubs/policydocs/pappguide/nsf10_tnsf10_1.pdf for more information

Submitting the Project Outcomes Report on Research.gov

PIs/co-PIs use Research.gov to submit a Project Outcomes Report that:

- Briefly summarizes the outcomes of the award (200–800 words)

For more information about Research.gov, please contact the National Science Foundation at feedback@research.gov.





E&M: A Federal context → *Evidence*



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E&M: A Federal context ➔ Evidence



EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF MANAGEMENT AND BUDGET
WASHINGTON, D.C. 20503

July 26, 2013

M-13-17

MEMORANDUM TO THE HEADS OF DEPARTMENTS AND AGENCIES

FROM: Sylvia M. Burwell *SMB*
Director, Office of Management and Budget
Cecilia Muñoz *C Muñoz*
Director, Domestic Policy Council



PUBLIC LAW 114-140—MAR. 30, 2016

Public Law 114-140
114th Congress

An Act

To establish the Commission on Evidence-Based Policymaking, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SECTION 1. SHORT TITLE.

This Act may be cited as the "Evidence-Based Policymaking Commission Act of 2016".

SEC. 2. ESTABLISHMENT.

There is established in the executive branch a commission to be known as the "Commission on Evidence-Based Policymaking" (in this Act referred to as the "Commission").

SEC. 3. MEMBERS OF THE COMMISSION.

(a) NUMBER AND APPOINTMENT.—The Commission shall be comprised of 15 members as follows:

- (1) Three shall be appointed by the President, of whom—
(A) one shall be an academic researcher, data expert, or have experience in administering programs;
(B) one shall be an expert in protecting personally identifiable information and data minimization; and
(C) one shall be the Director of the Office of Management and Budget (or the Director's designee).
- (2) Three shall be appointed by the Speaker of the House of Representatives, of whom—
(A) two shall be academic researchers, data experts, or have experience in administering programs; and
(B) one shall be an expert in protecting personally identifiable information and data minimization.
- (3) Three shall be appointed by the Minority Leader of the House of Representatives, of whom—
(A) two shall be academic researchers, data experts, or have experience in administering programs; and
(B) one shall be an expert in protecting personally identifiable information and data minimization.
- (4) Three shall be appointed by the Majority Leader of the Senate, of whom—
(A) two shall be academic researchers, data experts, or have experience in administering programs; and
(B) one shall be an expert in protecting personally identifiable information and data minimization.
- (5) Three shall be appointed by the Minority Leader of the Senate, of whom—

THE PROMISE OF EVIDENCE-BASED POLICYMAKING

Report of the Commission on Evidence-Based Policymaking

Transparency
Humility
Data
Privacy
Rigor
Capacity

6. BUILDING AND USING EVIDENCE TO IMPROVE GOVERNMENT EFFECTIVENESS

The Administration is committed to a vision for results-driven government that improves mission delivery and directs taxpayer dollars to the most effective and efficient purposes. Achieving this vision means ensuring accountability for results, having the necessary analytical tools, identifying and investing in effective practices, and accessing and using data to transform it into evidence that informs action. With strong evidence-based

or program operates, and practical and methodological considerations.

Routinely creating and using evidence requires a strong infrastructure and commitment. The President's 2018 Budget outlined widely accepted principles and practices for evaluation, which, along with similar principles and practices for Federal statistics, provide the foundation to build and use evidence. The 2018 Budget encouraged agencies to think about evidence-building broadly, highlighting how a range of analytic activities can contribute to building and using evidence. To be successful, however, agencies need a strong evidence infrastructure, including hiring and deploying trained staff; ensuring independence and rigor in statistics and evaluations; using cost-effective, cutting-edge methods; and bringing evidence to bear in policy and program decisions. This infrastructure will also support agencies in making better use of existing administrative data by ensuring that there are processes and tools in place to use and share data in appropriate and secure ways. This Budget reaffirms and builds upon these evidence principles and practices, and further articulates the Administration's vision for building and using evidence.

Current Federal Landscape

Building and using evidence: Ensuring that evidence can inform policy or program development and implementation requires coordination, agency leadership, available data, robust information technology and other tools, and relevant expertise, among other factors. Using evidence in decision-making entails ongoing coordination between those implementing and managing the operations of a program, including its data, and those responsible for using analysis to determine program effectiveness, opportunities for program improvement, and future policy options. Evidence-based policymaking requires strong leadership from multiple parts of an agency—agency officials, program administrators, performance managers, strategic planners, policy and budget staff, evaluators, analysts, and statisticians—to ensure that data and evidence are developed, analyzed, understood, and acted upon appropriately. Yet, current capacity in Federal agencies to build and use evidence varies widely. While some agencies have made great progress in integrating evidence into policy development, strategic planning, and day-to-day decision-making and operations, in other agencies, the creation and use of evidence is often isolated or limited.

Program evaluation: An important form of evidence-building is program evaluation. Evaluation involves the systematic application of rigorous scientific methods to assess the design, implementation, outcomes, or impact of a policy or program. Evaluation can answer essential questions regarding program effectiveness and cost-

ECONOMY NATIONAL SECURITY BUDGET IMMIGRATION THE OPIOID CRISIS

Office of Management and Budget

Evidence and Evaluation

The Administration is committed to building and using evidence to improve policy, program, budget, operational, and management decision-making. Our vision for evidence-based government includes ensuring accountability for results.

Strengthening Federal Evaluation Government-wide

Summary of Proposal: Bringing evidence to bear in decision-making is a critical component of good government. However, there are large gaps and inconsistencies across Federal agencies in their ability to formally evaluate their programs. These reforms would expand upon existing capabilities and push agencies to adopt stronger practices that would generate more evidence about what works and what needs improvement in order to inform mission-critical decisions and policies.

THE CHALLENGE

Decisions about how best to allocate taxpayer dollars and improve government services involve a complex set of factors, including political priorities, resistance to change, and the availability of credible evidence. In many policy domains, however, we lack key information on program effectiveness that could help us learn what works in order to focus limited funding on effective programs, discontinue programs that fall short of desired results, and identify ways to improve continually funded programs. For example, demonstrated positive impacts and future savings that warranted scaling up the program. In contrast, several high-quality evaluations that determined the program was ineffective and in some cases had negative effects.

These examples illustrate how, absent program evaluation, we would not know whether what we think works, does in fact work. Yet, building evaluation into program design so that we can learn and improve expectations, or guidance to Federal agencies regarding program evaluation. We must increase the ability to generate evidence about what works and how we can improve programs. This will lead to more and better information that the Congress and the President can use to make decisions about how to best spend taxpayer dollars and provide services for our citizens.

THE OPPORTUNITY

Passage of the Foreign Aid Transparency and Accountability Act of 2016 set an important precedent that our Nation must have expectations for monitoring and evaluating foreign assistance programs. OMB's across Government. We must set standards for evaluation across all program activities and agencies so that Federal agencies, OMB, the Congress, and taxpayers have critical information about the effectiveness of Government programs and policies, which will lead to improved services, increased efficiencies, and a greater return on investment.

DELIVERING GOVERNMENT SOLUTIONS IN THE 21ST CENTURY



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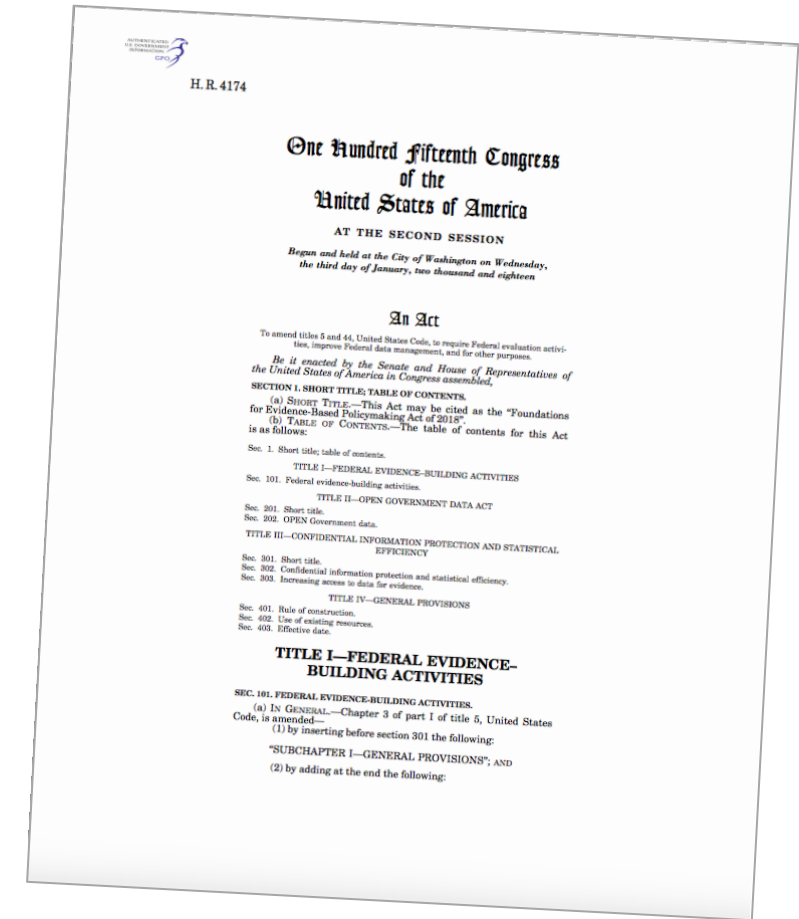
The Foundations for Evidence-Based Policymaking Act of 2018 Public Law No 115-435

Title I: Federal Evidence-Building Activities

- Agency evidence-building plan
- Evaluation Officers
- Statistical expertise
- Advisory Committee on Data for Evidence Building

Title II: Open Government Data Act

Title III: Confidential Information
Protection and Statistical Efficiency



EHR

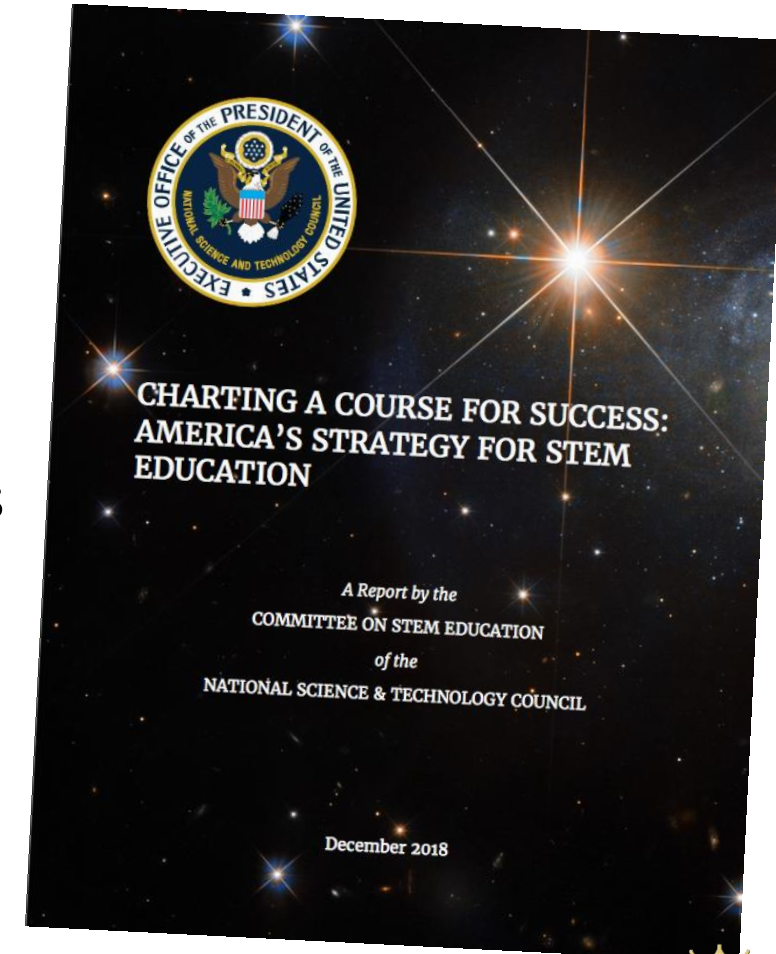
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Charting a Course for Success *Federal 5-year strategic plan for STEM education*

Operate with Transparency and Accountability

- Leverage and scale evidence-based practices across STEM communities
- Report participation rates of underrepresented groups
- Use common metrics to measure progress
- Make program performance and outcomes publicly available
- Develop a Federal implementation plan and track progress



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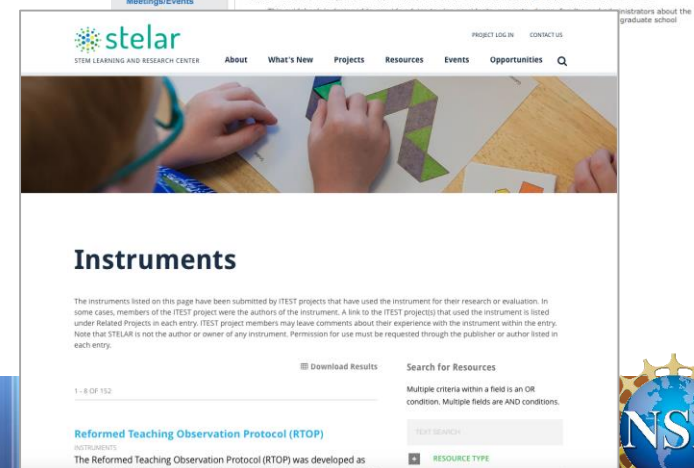
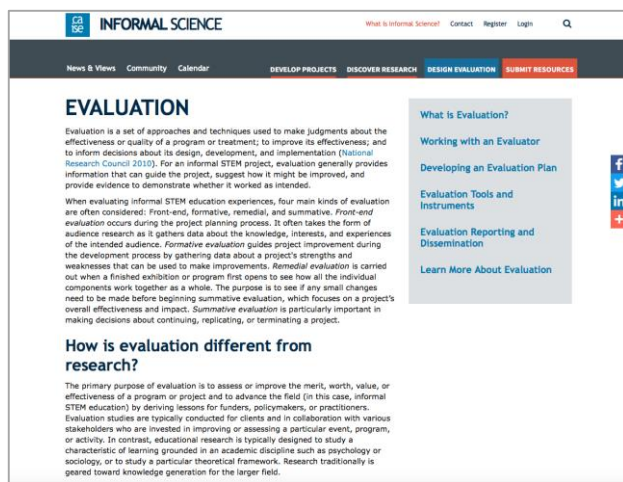
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EHR Evaluation & Monitoring Today

Resources: EHR continues to assist investigators in selecting appropriate mechanisms to assess success

1. Solicitation guidelines for project-level evaluation
2. Online repositories
3. Technical assistance



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EHR Evaluation & Monitoring Today

EHR continues to fund innovations & capacity-building in evaluation:

- EHR Core Research (ECR, [NSF 19-508](#))

EHR Core Research (ECR)

STEM Learning and Learning Environments, Broadening Participation, and Workforce Development

PROGRAM SOLICITATION

NSF 19-508

REPLACES DOCUMENT(S):

NSF 15-509



National Science Foundation
Directorate for Education & Human Resources
Division of Graduate Education
Division of Undergraduate Education
Division of Human Resource Development
Research on Learning in Formal and Informal Settings

Full Proposal Deadline(s) (due by 5 p.m. submitter's local time):

January 24, 2019

October 03, 2019

First Thursday in October, Annually Thereafter

IMPORTANT INFORMATION AND REVISION NOTES

This document is a program solicitation rather than a program description.

The Project Summary should now indicate the Research Track for the project and the proposal type: Level 1, Level 2, Level 3; synthesis; or conferences.

In Part II, under Program Description (Elements of ECR Proposals) the solicitation provides additional detail on expectations for the theoretical grounding, the research plan and methodology, a communication strategy, and external feedback for all proposals to ECR.

The Data Management Plan requirements for proposals submitted to the Directorate for Education and Human Resources (EHR) have been revised.

Clarifies that ECR supports research on evaluation methodologies including: (1) exploring innovative approaches for determining the impacts and usefulness of STEM education projects and programs (these can be qualitative or quantitative in nature, and may include computational methodologies where appropriate); (2) building on and expanding the theoretical foundations for evaluating STEM education and workforce development initiatives, including translating and adapting approaches from other fields; and (3) growing the capacity and infrastructure of the evaluation field. All evaluation methodology proposals should make clear linkages to one, or more, of the three research tracks as appropriate.



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EHR Evaluation & Monitoring Today

EHR continues to fund innovations & capacity-building in evaluation:

- EHR Core Research (ECR, [NSF 19-508](#))
- DCL: Developing and Testing New Methodologies for STEM Learning Research, Research Syntheses, and Evaluation ([NSF 19-036](#))



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EHR Evaluation & Monitoring Today

EHR continues to fund innovations & capacity-building in evaluation:

- EHR Core Research (ECR, [NSF 19-508](#))
- DCL: Developing and Testing New Methodologies for STEM Learning Research, Research Syntheses, and Evaluation ([NSF 19-036](#))
- EHR Core Research: Building Capacity in STEM Education Research (ECR: BCSER, [NSF 19-565](#))

EHR Core Research (ECR): Building Capacity in STEM Education Research (ECR: BCSER)

PROGRAM SOLICITATION

NSF 19-565



National Science Foundation

Directorate for Education & Human Resources
Division of Graduate Education
Division of Human Resource Development
Research on Learning in Formal and Informal Settings
Division of Undergraduate Education

Full Proposal Deadline(s) (due by 5 p.m. submitter's local time):

June 07, 2019

First Friday in June, Annually Thereafter

IMPORTANT INFORMATION AND REVISION NOTES

The Project Summary should indicate the activity for the project: individual investigator development, institutes in research methods, ECR Data Resource Hub, or conferences and workshops.

The Data Management Plan requirements for proposals submitted to the Directorate for Education and Human Resources (EHR) have been revised.

Any proposal submitted in response to this solicitation should be submitted in accordance with the revised NSF Proposal & Award Policies & Procedures Guide (PAPPG) (NSF 19-1), which is effective for proposals submitted, or due, on or after February 25, 2019.

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

EHR Core Research (ECR): Building Capacity in STEM Education Research

Synopsis of Program:

ECR's Building Capacity for STEM Education Research (ECR: BCSER) solicitation supports projects that build individuals' capacity to carry out high quality STEM education research that will enhance the nation's STEM education enterprise and broaden the pool of researchers that can conduct fundamental research in STEM learning and learning environments, broadening participation in STEM fields, and STEM workforce development.

Specifically, ECR: BCSER supports activities that enable early and mid-career researchers to acquire the requisite expertise and skills to conduct rigorous fundamental research in STEM education. ECR: BCSER seeks to fund research career development activities on topics that are relevant to qualitative and quantitative research methods and design, including the collection and analysis of new qualitative or quantitative data, secondary analyses using extant datasets, or meta-analyses.

This career development may be accomplished through investigator-initiated projects or through professional development institutes that enable researchers to integrate methodological strategies with theoretical and practical substantive issues in STEM education. Early and mid-career faculty new to STEM education research, particularly underrepresented minority faculty and faculty at minority-serving and two-year institutions, are encouraged to submit proposals.

As a special emphasis under this solicitation, ECR: BCSER seeks proposals that will result in a single award for the development and implementation of an ECR Data Resource Hub. The hub will facilitate data sharing and analysis and provide technical assistance to advance data skills, tools, and resources across the STEM education research community.



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EHR Evaluation & Monitoring: *Next steps include...*

- Reviewing guidance to prospective applicants re project-level evaluation → EHR
- Supporting efforts to identify and employ **common metrics** → EHR—NSF—Federal partners
- Exploring implications for program monitoring, portfolio analyses, and *(developmental, process, outcome, impact...)* evaluation → EHR—NSF—Federal partners
- Developing/contributing to the development of **learning agendas** & **evidence plans** → EHR—NSF



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From actions to success... *Learning agendas & evidence plans*

A *learning agenda* is conceived as a tool that will help an agency...

- “**Identify the most important questions** that need to be answered in order to improve program implementation and performance.”
- “Strategically prioritize these questions...”
- “Identify the most appropriate tools and methods...to answer each question.”
- “Conduct studies, evaluations, and analyses using the most rigorous methods that are feasible and most appropriate.”
- “Disseminate findings in ways that are accessible and useful to Administration and agency leadership, policy and program officers, state and local partners, practitioners, and other key stakeholders...”
- “Act on the results by using the information for policy decisions and continuous program improvement.”¹

¹See <https://www.govinfo.gov/content/pkg/BUDGET-2018-PER/pdf/BUDGET-2018-PER.pdf>



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From actions to success... *Learning agendas & evidence plans*

Thinking about the Key Federal Actions discussed earlier...

- What would "success" look like?
- What are the most important questions NSF/EHR should ask about its participation in these actions?



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From actions to success... *Learning agendas & evidence plans*

- What evidence of success would you find compelling?
 - For accountability purposes?
 - For continuous improvement purposes?
- How might EHR work (e.g., in partnership with your communities) to enhance capacity to assess success in accomplishing Key Federal Actions and/or Objectives under the plan?



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Lunch Break
11:30 – 12:30PM

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Session 3: Micro-Updates on Big Ideas and from EHR AC Subcommittees

Moderator: Jermelina Tupas, Acting Division Director
Division of Human Resource Development (HRD), EHR

- *NSF INCLUDES*, Sylvia James, Deputy Assistant Director, Office of the Assistant Director, EHR
- *Convergence Accelerators*, Evan Heit, Division Director, Division of Research on Learning in Formal and Informal Settings, EHR, Detailed to OIA

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Session 3: Micro-Updates on Big Ideas and from EHR AC Subcommittees

- *Future of STEM Education AC Subcommittee*, Margaret Honey, President & Chief Executive Officer, New York Hall of Science, and Chair, EHR AC Subcommittee on the Future of STEM Education
- *Broadening Participation AC Subcommittee*, Debra Joy Pérez, Senior Vice President of Organizational Culture, Inclusion and Equity at Simmons University and Chair, EHR AC Subcommittee on Broadening Participation
- *Public Private Partnership AC Subcommittee*, David H. Monk, Dean, College of Education, Penn State University and Member, EHR AC Subcommittee on Public Private Partnership



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NSF INCLUDES Update

Sylvia James

Deputy Assistant Director, Office of the
Assistant Director, EHR

EHR AC Meeting, April 25, 2019

National Science Foundation

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NSF INCLUDES Funding Opportunities

- **April 2, 2019** - Deadline for *NSF INCLUDES Alliances Solicitation* (NSF 18-529)
25 unique Alliance proposals received (actual submissions higher due to collaborations)
- **April 15, 2019** – Deadline for DCL *Supporting the Re-Entry of Women and Women Veterans in the STEM Workforce through NSF INCLUDES* (NSF 19-038)
6 conference proposals and 6 supplemental funding requests
- **May 6, 2019** – Deadline for DCL *Expanding the NSF INCLUDES National Network* (NSF 19-042, On-ramps and launch pilot supplements)

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NSF INCLUDES National Network Expansion

- **January 2019** - *Year 2 Annual Developmental Evaluation Report from 2M/Mathematica*
- **April 4, 2019** - *NSF INCLUDES Federal Partners Meeting (virtual)*
- **May 29-30, 2019** - *NSF INCLUDES National Network Convening (rescheduled from January 2019)*



NSF's Convergence Accelerator (C-Accel) Pilot

Evan Heit
April 25, 2019

<https://www.nsf.gov/od/oia/convergence-accelerator>

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Context

- NSF's 10 Big Ideas, including Growing Convergence Research, Harnessing the Data Revolution, and Future of Work at the Human-Technology Frontier
- NSF Strategic Plan for Fiscal Years 2018 – 2022. Agency Priority Goal to expand partnerships.
- Efforts to support commercialization, e.g., I-Corps, SBIR.

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What is a convergence accelerator?

Novel NSF initiative seeks nimble scientists to create better tools to tackle societal problems. But act now

By Jeffrey Mervis | Apr. 9, 2019 , 2:35 PM

Are you a scientist who wants to take a multidisciplinary, team approach to solving an important societal problem? Can you move quickly, think like an entrepreneur, and thrive under a short leash? Then the National Science Foundation (NSF) in Alexandria, Virginia, has a new funding program that might be a good fit.

The novel initiative, which next week has its first deadline for two-page preliminary proposals, goes by the hokey sounding name **Convergence Accelerator (C-Accel) pilot**. But NSF is dead serious about the funding. By the end of this summer, the agency envisions awarding up to \$1 million each to 50 teams for 9-month pilot projects. Those pilots will then compete for a smaller number of \$5 million awards extending into 2022.

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C-Accel Pilot Timeline

Phase 1:
Team formation
and research plan
development

Research Concept Outlines Target April 15, 2019	Proposals Due June 3, 2019	Projects Start Q3 2019	Pitch Competition Q1 2020
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Phase 2:
Creating
deliverables

Proposals Due Q1 2020	Projects Start Q2 2020	Deliverables Q2 2022
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Track A1

- Part of Harnessing the Data Revolution Big Idea
- Open Knowledge Network. Create a nonproprietary shared knowledge infrastructure, with a particular focus on publicly available U.S. Government and similar public datasets. Challenges include underlying representation of facts, services that perform reasoning tasks, and secured access. Domains include geosciences, education, smart health, and manufacturing.

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Track B1

- Part of Future of Work at the Human-Technology Frontier Big Idea.
- AI and Future Jobs. Develop tools to link workers with future jobs, reflecting the need for reskilling and lifelong learning. Components include predictive AI, labor market analyses, and educational technology. May focus on particular industries or regions, populations, or types of workplaces. Ethical and fair treatment of workers is essential.

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Track B2

- Part of Future of Work at the Human-Technology Frontier Big Idea.
- National Talent Ecosystem. Innovative approaches for employers to support workers seeking the skills required for 21st century work related to data science, predictive analytics, AI/machine learning, and other technologies of the future. Prototypes of learning environments, platforms, interfaces, or simulations, tools for analysis, assessment, or prediction, and vehicles for recruitment and engagement, with potential for take-up by industry.

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Update from the Future of STEM Education (FSE) Subcommittee of the EHR Advisory Committee

**Margaret Honey
Chair, FSE**

National Science Foundation



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**Update from the
Broadening Participation
Subcommittee (BPS) of the EHR
Advisory Committee**

**Debra Joy Perez
Chair, BPS**

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BPS Members

Dr. Debra Joy Perez – BPS Chairperson - Simmons University

Dr. Carlos Castillo-Chavez – Arizona State University

Dr. Rory Cooper – University of Pittsburgh

Dr. Okhee Lee – New York University

Dr. Marilyn Strutchens – Auburn University

Dr. Regina Sievert – BPS Executive Secretary - NSF EHR

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Broadening Participation Subcommittee's Focus

Are EHR investments paying off in broadening participation in STEM?

- Examining EHR programs that fund early career, post-doctorates, graduates and undergraduates – CAREER, PRF, GRFP, LSAMP, REU
- What are the career trajectories of EHR-funded scholars from underrepresented (UR) groups?
 - Are UR PIs securing funding after initial NSF support?
 - Are UR PIs making significant contributions to STEM?
- If so, how should EHR's efforts be expanded?
- If not, what new strategies should be initiated?

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Example Questions for Investigation

- How do CAREER, PRF, and GRF awards compare between EHR divisions and programs?
- How do CAREER, PRF, and GRF awards made by EHR compare to those from other directorates?
- Which UR groups are being funded: veterans, ethnicity, gender, first generation, disabilities, others?
- What is the nature of career advancement for funded UR groups? How does that compare to non-funded UR groups?

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Potential Analyses for CAREER Awards

1. Total NSF awards to PIs after receiving an EHR CAREER award
 - Do EHR CAREER awards correlate with higher rates of future funding?
2. Total publications of PIs who received an EHR CAREER award
 - Do EHR CAREER awards correlate with higher rates of research/publication?
3. Demographics of PIs who received an EHR CAREER award
 - How many EHR CAREER PIs are members of UR groups?
 - Are EHR CAREER awards and publications outcomes different for PIs from UR groups?
4. Comparison of EHR CAREER awards to those in other directorates
 - Do EHR CAREER awards differ from other directorates, e.g., by location, university, PI demographics, etc.?

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**Update from the
Public Private Partnerships (PPP)
Subcommittee of the EHR Advisory
Committee**

**David Monk
Member, PPP**

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**Mid-Afternoon
Break
1:15 – 1:30PM**

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Session 4: Committee Business Reports from Committees of Visitors (COVs)

Moderator: Corby Hovis
EHR COV Coordinator and Program Director

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NSF's Committee of Visitors (COV) Process

- Every NSF program must be reviewed by an external group of experts—a COV—every four years.
 - Transparency and accountability — Open up NSF's processes to outside experts.
 - Continuous improvement — Feedback ensures quality, effectiveness, and fairness of NSF's merit review process.
- COV acts as a subcommittee of the relevant Advisory Committee (e.g., EHR AC).
 - COV chair is a member of the Advisory Committee.
 - COV reports to the Advisory Committee through the COV chair (today's agenda).

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NSF's Committee of Visitors (COV) Process

- COVs may be asked to examine individual programs, or a cluster/thematic bundle of programs, or all programs in a division.
- Most of NSF has moved to *division-wide* COVs, and EHR has joined this trend.
- Division-wide approach allows a look *across programs* at execution of merit review process, cohesiveness of operations and management, and breadth of division's award portfolio.

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EHR's Division-Wide COVs

Meeting Dates	Division	COV Chair(s)
Mar. 30-31, 2015	Division of Research on Learning (DRL)	Margaret Honey and Gregory Camilli
Nov. 29, 2016	Division of Human Resource Development (HRD)	Francisco Rodriguez
Oct. 11-12, 2018	Division of Graduate Education (DGE)	Rory Cooper
Nov. 8-9, 2018	Division of Undergraduate Education (DUE)	Cathy Casserly

Today's Reports

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Scope of a COV Report

- Standard (NSF-wide) template of questions
- “Program” = unit being examined (programs, division)
- Time period: 4 fiscal years (in most cases)
- Major sections of report
 - I. Quality and Effectiveness of the Merit Review Process
 - II. Selection of Reviewers
 - III. Management of the Program
 - IV. Portfolio of AwardsOTHER TOPICS
- Data and documents (including a sample of proposal and award records) are provided at a private website (“eJacket COV Module”) to inform the COV’s answers to the questions

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Today's Reports

- Division-Wide COV for the Division of Undergraduate Education (DUE)

Introduction: Robin Wright, Division Director, DUE

Summary of Report: Cathy Casserly, COV Chair

Discussion/Q&A

- Division-Wide COV for the Division of Graduate Education (DGE)

Introduction: Nimmi Kannankutty, Acting Division Director, DGE

Summary of Report: Rory Cooper, COV Chair

Discussion/Q&A

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Today's Reports

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Discussion/Q&A

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Committee of Visitors for the
**Division of
Undergraduate Education (DUE)**

COV Meeting Dates: November 8-9, 2018

Report to the EHR Advisory Committee
Catherine M. Casserly, COV Chair

April 25, 2019



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Members of the COV

Cathy M. Casserly , Chair	Hewlett Foundation
Elizabeth A. Burroughs	Montana State University
Garikai Campbell	Knox College
Lesia L. Crumpton- Young	Tennessee State University
Lizanne DeStefano	Georgia Institute of Technology
Christopher J. Harris	WestED
José Herrera	Mercy College
Victoria L. Interrante	University of Minnesota
Dyan L. Jones	Mercyhurst University
Judy Kasabian	El Camino College
Eve A. Riskin	University of Washington

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DUE COV FINDINGS

Merit Review Process:

Comments:

- ▶ The COV noted that Program Officers have done an excellent job in managing high-quality reviews in light of increasing numbers of submissions.
- ▶ In some cases, the panel summaries seemed to be a cut-and-paste from an original individual panel review and did not capture the panel decision process.
- ▶ The Program Officers did an excellent job in stating the rationale for the award/decline decision and aligning that decision with the context statements.
- ▶ Some Program Officers routinely encourage resubmission; others encourage resubmission on selected proposals only.



DUE COV FINDINGS

Merit Review Process (cont.):

COV Recommendations:

- ▶ In addition to word count as a criterion for comparison between virtual and face-to-face reviews, other metrics should be included such as the quality of panelists and panel summaries, panel consensus and final project outcomes.
- ▶ An explicit strategy should be put in place to strengthen the panel consensus process. The current process of assigning one of the primary reviewers to write the panel summary and asking other reviewers to “sign off” does not seem robust enough to produce panel summaries that reflect consensus or lack thereof.
- ▶ NSF should explore the use of enhanced boilerplate language or a rubric to inform declines, particularly for first-time submitters/reviewers.
- ▶ NSF should explore the criteria that POs used to provide feedback on resubmission and judge its consistency and propriety.



DUE COV FINDINGS

Selection of Reviewers:

Comments:

- ▶ The COV commends the NSF Program Officers for convening appropriately diverse and expert panels.

COV Recommendations:

- ▶ The COV suggests that DUE provide a value proposition to institutions to incentivize them to allow faculty to participate in panel reviews. As an example, NSF could send dear colleague letters to presidents and provosts.

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DUE COV FINDINGS

Management of the Programs:

Comments:

- ▶ This division has done an excellent job of retaining well-qualified and knowledgeable Program Officers and staff across all four programs.
- ▶ The COV noted that all of the programs have regularly reviewed and updated solicitations.

COV Recommendations:

- ▶ An assessment of workload needs should be conducted to help identify the appropriate staffing and PO workload.
- ▶ In the S-STEM program, because the maximum dollar amount of individual student scholarship awards has remained unchanged for 13 years while the cost of education has risen consistently, the COV recommends that the maximum scholarship limits be reviewed.



DUE COV FINDINGS

Portfolio of Awards:

Comments:

- ▶ The COV commends the programs for having almost 40% of all awards be inter/multi- disciplinary, which is in line with the stated outcomes of the programs.
- ▶ While the COV recognizes the historical efforts being made, the COV expresses concern about the drop in awards to HBCUs , MSIs, and HSIs from 2016-2017.

COV Recommendations:

- ▶ The COV recommends that DUE investigate the barriers faced by institutions in underserved geographic areas regarding proposal submission and awards.
- ▶ The COV suggests an analysis of the awards by proximity to NSF Headquarters.
- ▶ The COV suggests that the data reporting the awards by type of institution (two-year college, bachelor's, master's, Ph.D.) be disaggregated by number of institutions and percent of proposals submitted to NSF, by program.

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DUE COV FINDINGS

Other Topics:

Comments:

- ▶ The COV recommends an examination of the program award data to minimize agencies and institutions from receiving disproportionate awards of funding in various ways.

COV Recommendations:

- ▶ The COV is concerned about the extent to which DUE attends to and tracks resubmissions of proposals that have high promise but are underdeveloped. The COV recommends an analysis of this issue in each of the programs.



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Today's Reports

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Introduction: Robin Wright, Division Director, DUE

Summary of Report: Cathy Casserly, COV Chair

Discussion/Q&A

- **Division-Wide COV for the Division of Graduate Education (DGE)**

Introduction: Nimmi Kannankutty, Acting Division Director, DGE

Summary of Report: Rory Cooper, COV Chair

Discussion/Q&A

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Committee of Visitors for the
**Division of
Graduate Education (DGE)**

COV Meeting Dates: October 11-12, 2018

Report to the EHR Advisory Committee
Rory Cooper, COV Chair

April 25, 2019



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Members of the COV

Rory Cooper, Chair	University of Pittsburgh
Terri Pigott	Loyola University of Chicago
Ernest McDuffie	The Global McDuffie Group
Michael Ashby	University of Oklahoma, Norman Campus
Sara Hernandez	Cornell University
Emmanuel Collins	University of Louisville
Sez Atamturktur	Penn State University
Diane Miller	Northrup Grumman Systems Corp.
Keivan Stassun	Vanderbilt University
Deanna Pennington	University of Texas, El Paso

DGE COV FINDINGS

Merit Review Process:

- ▶ The review process is working well.
- ▶ The individual reviews varied.
- ▶ The panel summaries were substantive.
- ▶ PO review analyses demonstrated excellent scholarship.

COV Recommendations:

- ▶ Consider including intersectionality as an explicit review criterion.
- ▶ Consider providing additional coaching and tools to help reviewers understand review expectations, standards for their comments and scores, and distinctions between Intellectual Merit and Broader Impacts.

DGE COV FINDINGS

Selection of Reviewers:

- ▶ DGE does an adequate job of finding a diverse set of qualified reviewers.

COV Recommendation:

- ▶ The COV suggests collecting and reporting more detailed and consistent characteristics of the panel members – demographic characteristics, position, rank (for faculty), areas of expertise, etc.
- ▶ There is insufficient data to determine if the panelists are a representative peer group of those whose proposals are being reviewed. Additionally, the method(s) of review used for all panels is unclear from the data. It would be helpful to include more complete and robust information about the panelists in the jackets.

DGE COV FINDINGS

Management of the Program:

- ▶ Management plans and strategic plans were useful.
- ▶ In general, dwell time appears appropriate.

COV Recommendations:

- ▶ GRFP and NRT program plans include logic models that could be emulated within the management plans for other DGE programs.
- ▶ The rationale for distribution of funding for GRFP across EHR and OIA is not clearly connected to programmatic objectives or priorities.
- ▶ Clearly the multiple years of operating on continuing resolutions have taken their toll on dwell time in some programs. There is some evidence for increased efficiency in processing more proposals with a bit less dwell time.



DGE COV FINDINGS

Portfolio of Awards:

- ▶ Given the focus of each program, the awards reflect an appropriate balance of different types of institutions.
- ▶ In general, graduate education and workforce development programs should be based on projected national workforce development needs and areas of growth.

COV Recommendations:

- ▶ Overall, given the scope of each project, the awards are of appropriate size and duration.
- ▶ SFS – The scholarships are standardized. The typical budget is for five years (8-13 scholarships).
- ▶ GRFP – The program provides 3-year fellowships over a 5-year period, which include an annual \$34,000 (\$32,000 in 2013) stipend and an annual \$12,000 (unchanged since 2013) cost-of-education allowance to the host institution. While responsive to inflation of cost-of-living, the cost-of-education allowance may not be keeping pace with rising tuition.

DGE COV FINDINGS

Other COV Recommendations:

- ▶ GRFP – The program needs modernization and to be made more strategic. Given evolving labor markets, GRFP awards might be distributed in areas of current and future national need, for example, as advised by the Bureau of Labor Statistics.
- ▶ There needs to be more follow-up to determine effectiveness/return on investment. A mentorship plan would be beneficial in reporting outcomes during and after funding. The recipients of GRFP grants should be required to submit Independent Development Plans (IDPs) with their first annual report, signed by their mentor(s).
- ▶ The unique challenges/traditions of individual disciplines and institutions are not recognized. A one-size-fits-all approach to addressing challenges in graduate education is unlikely to succeed. DGE is unique in that it is responsive to the entire directorate.

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DGE COV FINDINGS

- ▶ Several of the DGE programs require buy-in from other divisions. When a program is required to address the need of many who have diverse needs, natural tension exists.
- ▶ The COV Report Template was serviceable, but too generic for addressing the unique issues associated with individual programs. The answer to all of the questions was “yes, but”
- ▶ The COV believes NSF might improve efficiency and effectiveness in monitoring awarded proposals through the implementation of data analytics techniques and tools. The portfolio reviewed has a significant amount of related data; use of advanced tools to analyze performance at both the individual award and portfolio levels would facilitate greater oversight by the Program Officer, Division leadership, Directorate leadership, and NSF leadership.



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Next Steps

- After EHR AC accepts the COV report, it is posted on the NSF website at
<https://www.nsf.gov/od/oia/activities/cov/index.jsp>
- Division and EHR leaders write a “response” to the COV report, outlining actions they believe they can take to address the recommendations.
- Periodically, at EHR AC meetings, the division gives a status report on actions being taken.
- In four years, the next COV assesses whether responses have been appropriate.

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Session 5: *Graduate Education* ***AC Subcommittee Report***

Moderator: Nimmi Kannankutty
Acting Division Director, DGE, EHR

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Session 5: Graduate Education AC Subcommittee Report

Marilyn Strutchens
Chair, Graduate Education Subcommittee

Response to Recommendations

Graduate STEM Education for
the 21st Century
The National Academies, 2018



EHR AC Subcommittee



Charge

- The Subcommittee was charged to review the NASEM Graduate Education for the 21st Century Consensus Study Report, paying particular attention to the recommendations for Federal funding agencies and to offer their advice and recommendations as to how NSF should respond to the report.
- The Subcommittee delivered its report to the EHR AD and the Chair of the EHR Advisory committee.
- After review and acceptance by the EHR AC, the report will be presented to the NSF Assistant Directors for their review and possible action.

The NASEM Graduate Education for the 21st Century Consensus Study Report listed six recommendations for Federal funding agencies.

Recommendation 1.

Federal and state funding agencies should require institutions that receive support for graduate education to develop policies that require data collection on a number of metrics, including but not limited to demographics, funding mechanisms, and career outcomes, on current students and alumni at regular intervals for 15 years after graduation. Institutions should make these data available to qualify for traineeships, fellowships, and research assistantships.

NSF Funded initiatives which are collecting data on the career pathways of PhDs from a subset of doctoral institutions, gathering information about their professional aspirations, career pathways, and career preparation.

- **Council of Graduate Schools Multi-University Project to Understand Career Pathways of STEM PhD Students and Alumni:** <https://cgsnet.Org/cgs-announces-multi-university-project-understand-career-pathways-stem-phd-students-and-alumni>
- **Andrew W. Mellon Foundation:** <https://cgsnet.org/cgs-announces-multi-university-project-collect-data-career-pathways-humanities-phds>
- **Alfred P. Sloan Foundation:** <https://cgsnet.org/cgs-launches-project-study-feasibility-tracking-phd-career-pathways>

Responses to the Recommendation 1 by the Subcommittee:

The subcommittee as a whole feels that this recommendation in its entirety would be difficult to achieve.

- The subcommittee views requiring detailed data on the career paths of graduate students as a highly desirable goal, but there are obstacles to their collection.
- Mandating such data without funding and having its collection decentralized are likely to lead to low quality data with inconsistent information.
- Centralized and consistent standards for the data collection, funding, and pilot studies would be needed to advance this recommendation.

Recommendation 2:

Federal agencies, such as the National Science Foundation, and state agencies that fund graduate STEM education should issue calls for proposals to better understand the graduate education system and outcomes of various interventions and policies, including but not limited to: the effect of different funding mechanisms on outcomes for doctoral students; studies on career outcomes related to Master's students; the ways to integrate Master's students into the STEM workforce and research and development ecosystem; the effect of expanding eligibility of international students to be supported on federal fellowships and training grants; and the effect of different models of graduate education on knowledge, competencies, mind-sets, and career outcomes.

Responses to the Recommendation 2 by the Subcommittee:

The subcommittee feels that this is a very sensible recommendation.

1. Prior to any calls for original research, funding agencies, such as the NSF, should consider issuing calls for proposals for a synthesis of the research on the graduate education system in the US (including the effects of interventions/policies and funding mechanisms).
2. Findings from #1 could then inform a more targeted call for new research improving the likelihood that new scholarship would systematically build on what is already known and address key gaps in the knowledge base.
3. The subcommittee fully appreciates the focus of the report on STEM in general but recommends that any calls for proposals should encourage careful attention to particular STEM disciplines in higher education; it is clear that the subject/discipline shapes the education experience.

Responses to the Recommendation 2 by the Subcommittee:

- At a minimum, consideration should be given to possible graduate education differences found in the following areas:
 - Engineering
 - Physical Sciences
 - Mathematical Sciences
 - Computer Science
 - Biological/Living Resources Sciences
 - Social, Behavioral and Economic Sciences
 - Medical and Health Sciences
- 4. With respect to interventions and policies (including providing funding to universities): the subcommittee thinks a first step should be to systematically identify major policies/interventions on graduate education over the past 20 or 30 years.

Responses to the Recommendation 2 by the Subcommittee:

5. Similar research might be possible at the individual graduate student level focusing on students who receive funding and comparing them to those who just missed out on funding (e.g., made the next to last cut but did not get an award).
6. With respect to the recommendation to study the effect of expanding eligibility of international students to be supported on federal fellowships and training grants, the subcommittee recognizes that eligibility for some programs is specified in Federal law.
7. The subcommittee thinks NSF should consider whether this recommendation would allow for a call for proposals on graduate teaching and learning, in particular teaching.

Responses to the Recommendation 2 by the Subcommittee:

8. Finally, the subcommittee is struck by the absence of attention to recommendations relevant to improving the quality of the next generation of STEM teachers in K - 12 and beyond at the university level.

Recommendation 3:

Federal and state funding agencies should align their policies and award criteria to ensure that students in the programs they support experience the kind of graduate education outlined in this report and achieve the scientific and professional competencies articulated here, whether they are on training or research grant mechanisms.

Responses to the Recommendation 3 by the Subcommittee:

The committee members are broadly in support of this recommendation and endorse the competencies outlined as centrally relevant to graduate education, with some caveats, as outlined below.

- The **core competencies** proposed for Master's education derive from the Council of Graduate Schools and include:
 - *Disciplinary and interdisciplinary knowledge*
 - *Professional competencies*
 - *Foundational and transferable skills*
 - *Research experience*
- The core competencies proposed for Ph.D. education are based on a community survey of unknown sample size and include:
 - *Scientific and technological literacy and original research*
 - *Leadership, communication and professional competencies*

Responses to the Recommendation 3 by the Subcommittee:

- While supportive of these core competencies, the committee felt that a strong separation of disciplines:
 - Engineering
 - Physical Sciences
 - Mathematical Sciences
 - Computer Science
 - Biological/Living Resources Sciences
 - Social, Behavioral and Economic Sciences
 - Medical and Health Sciences and degrees:
 - Professional Masters
 - Research Masters
 - PhDs

is essential, as the career paths of the students pursuing these discipline-by-degree options are quite different.

Responses to the Recommendation 3 by the Subcommittee:

- In pursuit of the "ideal" graduate education, the report also discusses the importance of **career exploration, communication skills, and project-based learning**.
 - The Subcommittee recognizes that the most beneficial career exploration options will differ by discipline and by type of degree and fully supports the idea of encouraging the pursuit of one or more of the opportunities outlined in the report:
 - faculty guidance/mentoring of undergraduate students regarding Master's programs
 - integration of professional development into curriculum design
 - integration of professional development into professional society programming
 - selection of "optimal" programs by prospective Master's students
 - guidance and financial support from employers supporting student professional development, including internships

Responses to the Recommendation 3 by the Subcommittee:

- The report encourages opportunities for students to communicate their work and the broader impacts of their research, and the subcommittee is broadly in support of this suggestion.
- The report encourages project-based learning as the norm: "experiences where students learn by doing rather than simply learn by lecturing and coursework." However, some disagreed with the implication that project-based learning is superior to classroom work. In fact, both approaches are important and which of the approaches is better depends on what one is trying to accomplish.

Responses to the Recommendation 3 by the Subcommittee:

- The report strongly advocates for verification that the competencies are achieved, and that institutions provide easily accessible information about how programs reflect the competencies. These are both excellent goals, although the details—who bears the costs and the degree to which this work can be centralized so that all institutions are using similar/same measures and metrics—are not addressed in the report.
- The recommendation that funding institutions should tie graduate funding to the competency provisions: "ensure that they develop, measure, and report student progress toward acquiring the scientific and professional competencies outlined in this report" (for Master's level) and create "fully transparent, easily accessible data about costs incurred and viable career pathways and successes of previous students at the level of the institution and its departments" is problematic and not supported by the committee.
- Before the NSF ties any funding directly to these recommended competencies and institutional proof of same, more research into defining the desired outcomes, and how those might differ among disciplines, as well as a holistic assessment of the impact of such changes on the system—including students, faculty, institutions and funders—is required.

Responses to the Recommendation 3 by the Subcommittee:

- Instead, the NSF could assist institutions in aligning with these competencies by:
 - Increasing programs like INTERN and expanding eligibility criteria to make funding available to more than just current grant holders.
 - Increasing/codifying interdisciplinary, team-based graduate programs like IGERT/NRT and PIRE.
 - Creating a stand-alone funding program that crosses the directorates (EHR and the Research & Related Activities directorates) for Distributed Graduate Seminars as another means to fund transdisciplinary, team-based research where graduate students from several institutions have the opportunity to lead the work, supported by the faculty.

Responses to the Recommendation 3 by the Subcommittee:

- Developing the structural framework of a graduate IDP for use in all NSF-funded research work supporting students. It would also be valuable to fund an outcomes and impacts assessment to determine whether students, departments and/or institutions using IDPs graduate sooner, produce more and/or higher quality scholarly products, and are better prepared for ensuing career steps.
- Requiring a separate (small) paragraph in the "Prior NSF Support" section of all proposals that specifically details the scholarly products and accolades (e.g., first-authored published papers, oral presentations at international and national society meetings/conferences/symposia, and awards received) of graduate students funded on the grant(s) as separate from those produced by the PI(s) and other funded personnel. This rearrangement of currently required information would highlight student work to reviewers.
- Convening one or more workshops, together with other major graduate funders, to discuss/debate formalizing evidence of successful teamwork (and potentially other non-disciplinary skills, e.g. science communication) in the degree process (e.g., as evidenced by successful completion of an exam or product including a multi-authored chapter in the dissertation, a paper presented at a national meeting, etc.).

Recommendation 4:

Federal and state agencies should embed diversity and inclusion metrics in their funding criteria. They should also adjust their grant award policies and funding criteria to include policies that incentivize diversity, equity, and inclusion, and they should include accountability measures through reporting mechanisms.

Responses to the Recommendation 4 by the Subcommittee:

The Subcommittee broadly agrees with Recommendation 4.

- The Subcommittee addresses each component of the recommendation below.
 - **Embed diversity and inclusion metrics in funding criteria.**
 - Most of the Subcommittee members feel that NSF's Merit Criteria statement related to broadening participation is not strong enough. Instead, the subcommittee suggests that improved merit criteria be created for Broader Impacts that include greater consideration of broadening participation. More efforts should be made to ensure that the graduate student selection process does not discriminate on the basis of first generation; Gay, Lesbian, Bisexual, Transgender, and Queer (GLBTQ) identity; race; class; and national origin.
 - The subcommittee also suggests that researchers consider including metrics other than the traditional ones, such as GRE scores and GPA, for accepting potential graduate students in programs funded by NSF.
 - Moreover, rubrics could be designed to highlight particular traits that potential graduate students would need to have related to specific fields.
 - Importantly, institutional support to broaden participation should extend beyond the recruitment phase and include efforts to retain diverse students by addressing institutional norms and cultures that preclude their retention and success.

Responses to the Recommendation 4 by the Subcommittee:

- **Adjust grant and award policies and funding criteria to include policies that incentivize diversity, equity, and inclusion.**
 - In addition, the Subcommittee encourages NSF to expand its Broadening Participation portfolio by increasing the number of programs that make broadening participation an explicit review criteria and by prioritizing proposals that link to the NSF INCLUDES program.
- **Include accountability measures through reporting mechanisms.**
 - The Subcommittee recommends that the NSF expands its gathering of information about how broadening participation is /was addressed during a funded research project.

Recommendation 5:

Federal and state funding agencies that support or conduct education research should support studies on how different STEM disciplines can integrate the changing scientific enterprise into graduate education programs and curricula.

Responses to the Recommendation 5 by the Subcommittee:

The subcommittee was skeptical about the value of this recommendation.

- The subcommittee recommended that the NSF do a thorough review of the literature and/or existing funded studies before soliciting proposals to study how to incorporate changes in STEM workforce needs into graduate curricula. If this review shows that new studies are desirable, they should be focused on specific disciplines or disciplinary clusters where they appear most needed.
- It also recommended that NSF consider more traditional approaches, e.g., require graduate student mentoring plans in proposals and team work and leadership skills development for NRT trainees, before embarking on this recommendation.

Recommendation 6:

Federal and state agencies that support graduate education should require STEM doctoral students to create and update annually individual development plans in consultation with faculty advisors to map educational goals, career exploration, and professional development.

Responses to the Recommendation 6 by the Subcommittee:

The subcommittee supports the recommendation that STEM doctoral students should work with their advisor, and research and academic mentor(s) to create and annually update an individual development plan (IDP).

- There was broad support for IDPs, but not a consensus on requiring them until scientific evidence shows that IDPs work as expected.

Responses to the Recommendation 6 by the Subcommittee:

- NSF could assist faculty and students in meeting this recommendation by:
 - Advancing training opportunities, including:
 - Developing and/or providing an IDP template accessible on-line to all students and faculty; For example, the NSF might consider investing in an update of the MyIDP platform that is hosted by the AAAS.
 - Developing and/or providing guidelines for best practices in mentoring graduate students accessible on-line to all students and faculty; such a document could be developed through existing collaborative mechanisms (e.g., Ideas Lab, workshop, RCN) involving educational research/mentoring professionals, and faculty and PhD students from disciplines supported by the NSF;
 - Providing NSF-funded faculty with in-person training opportunities (e.g., workshops attached to PI meetings and/or to national scholarly meetings with significant NSF-funded presence, workshops at synthesis centers) in mentoring and IDP development; and
 - Providing on-line training opportunities in IDP development and in student mentoring including but not limited to webinars, Zoom or other interactive video-conference sessions, automated scenario-based learning sessions.

Responses to the Recommendation 6 by the Subcommittee:

- Instituting proposal and reporting requirements, including:
 - Demonstration/documentation that the proposing PIs have completed training in mentoring and IDP development (dependent on the NSF providing and/or identifying easily accessible training opportunities for all faculty);
 - Submission of a draft IDP as additional documentation for all grant proposals that include graduate student funding;
 - Submission of annual and final reports by PI(s) that include a section within contributions to human resource development and education and training, which explicitly highlights IDP outputs, objectives and goals achieved, and the mentor-mentee interactions underlying those successes;
 - PIs of graduate training grants demonstrate that they have received training in mentoring, diversity and inclusion, and training grant proposals include a section on how all faculty involved in the project will be trained in mentoring; and
 - Faculty advisors of students supported by the GRFP receive training in mentoring, diversity and inclusion.

AC Graduate Subcommittee Members

Marilyn Strutchens (Chair), member of the Advisory Committee of the EHR

Jim Spillane, member of the Advisory Committee of the EHR

Pamela Kempton, member of the Advisory Committee for GEO

Julia Parrish, member of the Advisory Committee for OIA-AC_ERE

Kenneth Bollen, member of the Advisory Committee for SBE

Robert Schnabel, member of the Advisory Committee for CISE

Suzanne Barbour, member of the Advisory Committee for OIA-CEOSE

Carla Caceres, member of the Advisory Committee for BIO

Caroline Wagner, member of the Advisory Committee for OISE

Gregory Washington, member of the Advisory Committee for ENG

William Lewis, Former Acting Assistant Director of EHR and Earnestine Easter, Program Director, Division of Graduate Education, EHR provided meaningful guidance and assistance to the subcommittee.

EHR

DIRECTORATE FOR
EDUCATION & HUMAN RESOURCES



Afternoon Break

3:45 – 4:00PM

EHR

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**Prepare to Meet
Dr. F. Fleming Crim
Chief Operating Officer, NSF**

Moderator:
Francisco Rodriguez
EHR AC Chair

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EDUCATION & HUMAN RESOURCES



Talk with Dr. F. Fleming Crim Chief Operating Officer, NSF



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Closing Remarks

Francisco Rodriguez
EHR AC Chair